UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
H. H. BENNETT, CHIEF

NORTHEASTERN REGION
AUSTIN L. PATRICK, REGIONAL DIRECTOR

REPORT ON SEDIMENTATION IN SCHOHARIE RESERVOIR

New York City
Water Supply System
Prattsville, New York

By William R. Moore, Soil Conservationist
and
H. James Ferris, Soil Scientist
Soil Conservation Service

SCS-TP-105
Upper Darby, Pa.
June 1951

United States Department of Agriculture
Soil Conservation Service
H. H. Bennett, Chief
Northeastern Region
Austin L. Patrick, Regional Director

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View of Gilboa Dam

T A B L E S

F I G U R E S

CONTENTS

INTRODUCTION

This is a report on a detailed sedimentation survey of Schoharie Reservoir, a part of the New York City water supply system, located near Prattsville, New York. The survey was made during May 1950.

The purposes of the survey were: (1) to determine the original and present capacity of Schoharie Reservoir and the average annual loss of capacity by sedimentation; (2) to evaluate the past rate of sediment contribution per unit of drainage area; (3) to provide a basis for determining the effects of a watershed treatment program in prolonging the useful life of the reservoir; and (4) to recommend future studies of specific problems.

ACKNOWLEDGMENTS

Personnel and equipment were furnished by the City of New York, Department of Water Supply, Gas and Electricity. Johaan Aalto, civil engineer, and A. E. Moore, assistant civil engineer, supplied information on the history of the reservoir. John H. Wetzel, Chief, Regional Water Conservation Division, Soil Conservation Service, Upper Darby, Pa., made preliminary contacts with New York City officials and arranged for the acquisition of specialized survey equipment.

The survey was made by Ross E. Rogers, sedimentation specialist, who was chief of party, William R. Moore and H. James Ferris, of the Soil Conservation Service, and Irvin C. Reigner of the Forest Service. Mr. Rogers helped to compile the sections of the report dealing with amount and distribution of sediment in the reservoir and L. C. Gottschalk, Head, Sedimentation Section, Soil Conservation Service, spent several days with the survey party at the beginning of the survey. Both men reviewed the report. Conservation survey information was furnished by H. R. Adams, Chief, Conservation Surveys Division, Soil Conservation Service, Upper Darby, Pa. Irvin C. Reigner and Nedavia Bethlahmy, Northeastern Forest Experiment Station, Forest Service, supplied equipment and made a detailed field study to furnish information on roadbanks, streambanks, and reservoir shorebanks.

DAM AND RESERVOIR

Gilboa Dam is located on Schoharie Creek at latitude 74° 26' North, longitude 42° 23' West, four miles northeast of Grand Gorge in Gilboa Township, Schoharie County, New York.

The dam is composed of two parts -- an overflow spillway section and an earthfill section. The spillway section is a cyclopean masonry structure 1,324 feet long with top elevation of 1,130 feet and top width of 15 feet. The east end of the spillway ties into the hillside of Schoharie Creek. The west end ties in with the dike section that extends across the valley approximately 1,000 feet. The dike curves on an arc from the spillway, swinging to a northwesterly direction. The top width is 24 feet at elevation 1,150 feet. It is a compacted earth-fill with concrete core wall up to elevation 1,130 feet. The upstream slope is 3:1 to elevation 1,130 feet and 4:1 below

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SCHOHARIE RESERVOIR
LOCALITY MAP

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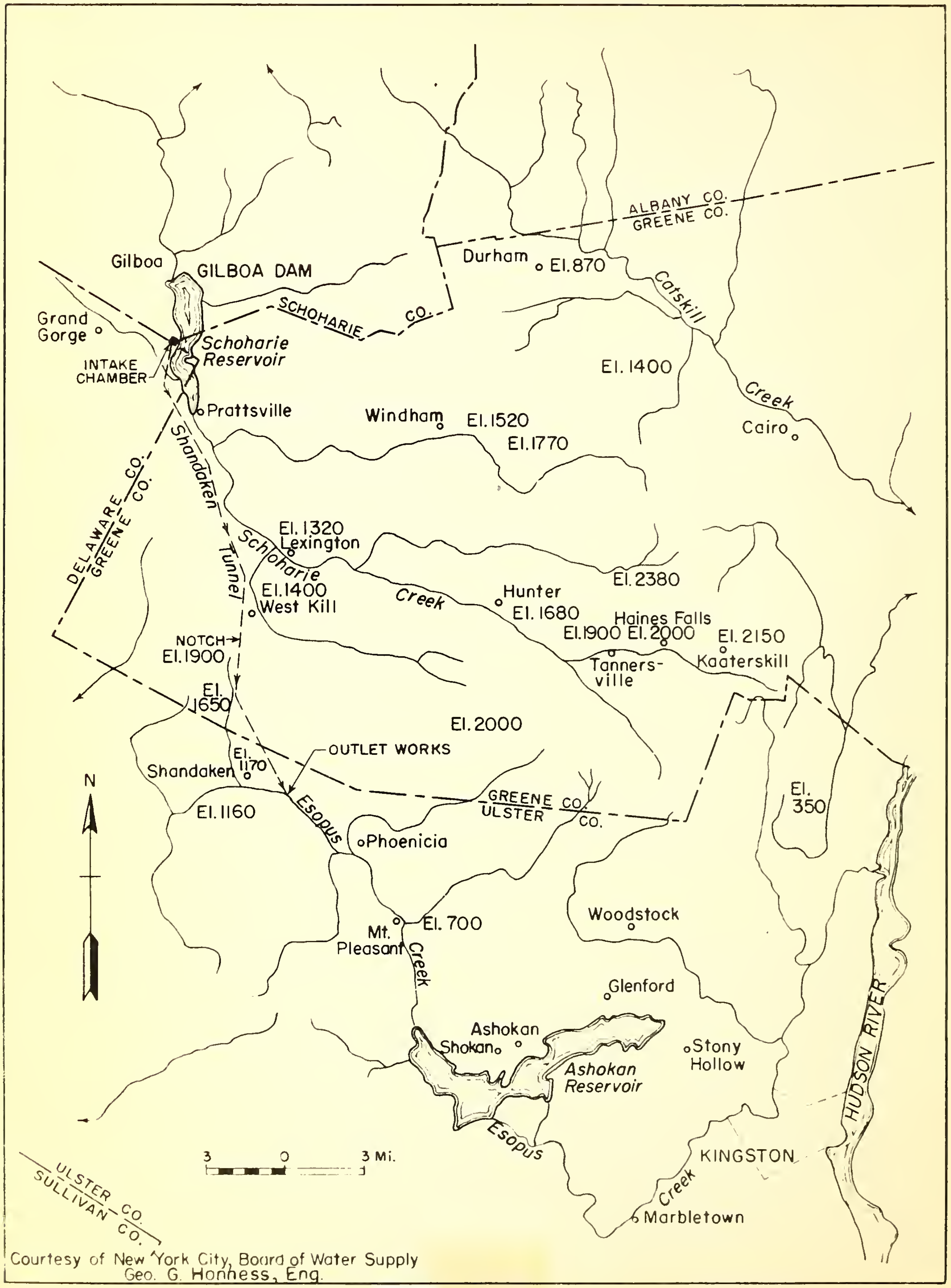

UPPER DARBY PA JULY 1951

Fig. 1

elevation 1,130. The downstream slope is 2.5:1. Both upstream and downstream slopes are protected by rock riprap set in concrete. Bottom elevation of the dike is 1,000 feet.

The controlled outlet system consists of two 30-inch hydraulically operated gate valves. They are located at center line elevation, 990.5 feet in the dike section near the spillway, and control the flow of a blow-off conduit. The blow-off conduit is 5 feet 7 inches in diameter, concrete lined, with bottom elevation of 988.0 feet. Along the downstream toe of the dam is a flume for collecting and conveying the over-flow waters from the spillway into the present channel of Schoharie Creek.

The official name of the lake formed by Gilboa Dam is Schoharie Reservoir. The lake is approximately five miles long. Maximum width is about one mile with an average width of about 1,800 feet, extending from Gilboa to Prattsville. Immediately adjacent to the lake the topography is steep. Forest covered hills range up to 850 feet above the water. The water-surface area of the reservoir at crest stage (elevation 1130) is 1,145 acres. The total original storage capacity, based on the results of the present survey, was 63,821 acre-feet, or 20.8 billion gallons. It is part of the Catskill System of the New York City water supply and the highest reservoir of the entire system.

Gilboa Dam diverts the flow of Schoharie Creek through the concrete-lined Shandaken Tunnel into Esopus Creek whence it flows into the Ashokan Storage Reservoir. The tunnel, 18 miles long, has inside dimensions of 11.50 feet high by 10.25 feet wide. The entrance is located about 3-1/2 miles north of the head of backwater at Prattsville. A gatehouse, shown on the reservoir map, figure 6, is directly above the tunnel entrance. It houses the controls for regulating flow through the tunnel and instruments for gauging and recording the volume of flow. The tunnel sill is at elevation 1,050. The original usable capacity above this elevation was 57,840 acre-feet, or 18.8 billion gallons. Water can be delivered through the tunnel at a maximum rate of 650 million gallons per day.

The average daily delivered outflow from Schoharie Reservoir to the Ashokan Reservoir in 1948 was 276.1 million gallons. The average daily amount of water supplied to New York City from all sources in 1948 was 1162.3 million gallons, of which Schoharie Reservoir supplied 23.8 percent.

THE DRAINAGE AREA

Physiography and Geology

The watershed is approximately 314 square miles in area. It lies in a southeast direction from the lake in Delaware, Schoharie, and Greene Counties. The upper part of it is in the Catskill Mountains. The remainder is in the rolling country bordering the mountain area. A study was made of soil, slope, and land use conditions in the watershed by stereoscopic analysis of aerial photographs and of existing soil survey data.

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SCHOHARIE RESERVOIR WATERSHED
NEW YORK

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Fig 2

The results indicate that approximately 60 percent of the watershed is steep, with slopes exceeding 20 percent. Less than 5 percent of the watershed is on level or gently sloping land with little or no erosion hazard. Elevations range from 988 feet at the base of the dam to 4,028 feet, the highest point in the watershed.

The entire drainage basin was glaciated during the late Wisconsin stage, resulting not only in a greatly modified general topography, but in the displacement of all preexisting soils by a mantle of glacial debris. The uplands are a combination of sandstone and shale covered by glacial till. Smooth terraces of water-deposited material occur at low elevations and as narrow overflow plains along all streams. Nearly all of the severe erosion in the watershed occurs on soils developed on those water-deposited materials.

Soils and Erosion

Most of the soils in the area have relatively good natural drainage and are found on sloping and steeply sloping land. They are stony and shallow with bedrock at depths of less than three feet. The soils with poor natural drainage are found generally on the level land and gentle slopes on both the upland and valley floors. Severe erosion is occurring on about one-half of one percent of the watershed area, and moderate erosion on about 46 percent of the area. Nearly all of the severe erosion occurs on soils derived from lacustrine silts and clays lying on moderate to steep slopes immediately adjacent to the reservoir.

Land Use Capability

According to the study of watershed conditions, 55.1 percent of the area is in woodland and 43.57 percent is in grass.

Table 1 shows the present land use of watershed lands by capability classes.

Table 1. - Present land use by capability classes

	I	II	III	IV	VI	VII	Percent of Watershed
	%	%	%	%	%	%	
Cultivated	.03	.46	.40	-	.10	.08	1.05
Grassland	.02	2.54	13.56	.15	7.19	20.11	43.57
Woodland	-	.68	1.14	.02	6.14	47.12	55.10
Urban	-	.14	.13	-	-	.01	.28
Percent of Watershed	.05	3.82	15.23	.17	13.43	67.30	100.00

Class I - Suitable for cultivation with ordinary farm practices.
Class II - Suitable for cultivation with simple conservation practices.

Class III - Suitable for cultivation with more complex conservation practices.
Class IV - Suitable for limited cultivation.
Class VI - Not suited for cultivation. Moderate limitations for grazing or forestry.
Class VII - Not suited for cultivation. Severe limitations for grazing or forestry. Best suited to forestry or wildlife.

Approximately 19 percent of the watershed lands are suitable for cultivation with varying degrees of conservation practices. Only 4.7 percent of this suitable area was actually in cultivation at the time of the survey. Very little cultivation was taking place on Class VI and VII lands. Twenty percent of the watershed was in pasture on Class VII land, most of which would be better suited for woodland.

SOURCES OF SEDIMENT

There was at the time of the survey, a total of 1,119 acre-feet of sediment in Schoharie Reservoir. In addition, 112 acre-feet is estimated to have passed out through Shandaken Tunnel. Inspection of the watershed and analysis of the watershed data indicates that about 94.2 percent of the sediment reaching the reservoir was derived from sheet erosion, 3.7 percent from streambank erosion, 1.5 percent from roadside erosion, and .6 percent from shorebank erosion.

Erosion of streambanks, roadbanks, and shorebanks was investigated in the field by a sampling-type survey. The sediment not derived from these sources comes from sheet erosion. The following sections summarize the results.

Sheet Erosion

Sheet erosion is the removal of soil or soil material from the land surface by forces of raindrop impact followed by surface runoff.

Estimates of the relative severity of sheet erosion were based on the existing soil conservation survey data for scattered farms and stereoscopic analysis of aerial photographs.

Field surveys indicated that streambank, roadbank, and shore erosion can account for only 5.8 percent of the annual sedimentation in the reservoir. If it is assumed that all the sediment derived from these sources is deposited in the reservoir the remainder (94.2 percent) must be derived from sheet erosion of the watershed lands, as no other sources of sediment exist in the watershed.

Approximately half of one percent of the area has been severely eroded and about 46 percent has been moderately eroded. Most of the severe erosion occurs on moderate to steep slopes on lacustrine silts and clays adjacent to the reservoir. It is estimated that half of this area is used for crops in a long rotation with infrequent plowing.

Moderate erosion is distributed principally in the pasture areas. Much of this pasture occurs on steep slopes with shallow soils and is overgrazed. This results in poor cover, which makes the soils susceptible to sheet erosion.

Streambank Erosion

Volume computations show the amount of material removed by streambank erosion is approximately 1.9 acre-feet per year. Assuming that all of this material is carried into the reservoir, it is equal to 3.7 percent of the total annual accumulation of sediment in the reservoir. Table 2 shows the percent of erosion by degree in each stream class.

Table 2. - Streambank erosion

Stream Class	Slight	Moderate	
	Percent	Percent	Bank Surface (acres)
1. (22.70 Mi.)	92	8	2.5
2. (53.84 Mi.)	88	12	7.3
3. (331.90 Mi.)	98	2	3.2
TOTAL			13.0

Slight erosion - No visible evidence or insignificant evidence of erosion.

Moderate erosion - Vertical or undercut banks; soil erodible with little consolidated material; small gullies or other evidence of washing present.

Severe erosion - No severe erosion was encountered.

Class 1 streams - Schoharie Creek from the reservoir to the point at which it loses its main stream characteristics among smaller tributaries.

Class 2 streams - Larger tributaries, Manor Kill, Batavia Kill, East Kill, and West Kill, from Schoharie Creek to their respective headwaters.

Class 3 streams - All small tributaries and subtributaries.

Roadside Erosion

The hilly terrain has made it necessary to excavate deep road cuts that for the most part are left with steep unvegetated slopes. In some places ditches with steep side slopes have been dug below the cuts to carry off excess surface water. The slopes are continually caving and eroding and the ditches beneath them are scouring.

Maps of the area show four classes of roads: (1) hard surface, heavy duty roads; (2) secondary, hard surface, all weather roads; (3) loose surface, graded, dry weather roads; and (4) dirt roads.

Eroding stream bank along Batavia Kill
tributary of Schoharie Creek, Greene County, New York

Roadbank erosion two miles west of
Ashland, New York

Rates of soil loss on roadbanks were estimated by use of a nomograph. The nomograph, with the aid of a straightedge, makes it possible to take a known rate of erosion for a given soil type, apply to it such variables as slope, slope length, cover, and rainfall, and read off a new rate of erosion as affected by those specific conditions. The rates as estimated were applied to the roadbank erosion groups in table 3. The computation showed that 0.78 acre-feet of potential sediment is produced each year by the roads and roadbanks in the Schoharie Watershed. If it is assumed that all of this material is carried into the reservoir, it would represent 1.5 percent of the sediment annually deposited.

Table 3. - Roadside erosion

Road Class	Slight	Moderate				Severe	
	Percent	Percent	Bank Surface	Road Surface	Shoulder Surface	Percent	Road Surface
			(acres)	(acres)	(acres)		(acres)
1. (71.56 Mi.)	86	14	11	-	1	-	-
2. (103.11 Mi.)	98	2	3	-	-	-	-
3. (144.88 Mi.)	73	27	1	44	-	-	-
4. (107.61 Mi.)	58	40	3	41	-	2	3
TOTAL			18	85	1		3

Slight erosion - No visible evidence or insignificant evidence of erosion.

Moderate erosion - Soil erodible with little consolidated material; some material deposited at bottom of bank or in culverts.

Severe erosion - Erodible soil, unconsolidated; gullies developed with considerable deposits at bottom of slope.

Shorebank Erosion

The annual rates of soil loss applicable to the area were determined and applied to the acreages in table 4. It was estimated that 0.3 acre-foot of sediment was deposited in the reservoir each year from this source.

Table 4. - Reservoir shorebank erosion

	Moderate Erosion	Severe Erosion
Lineal distance (feet)	17,080	2,900
Percent of total shore length (14.42 miles)	22.5	3.7
Acres	3.70	1.97

All eroding areas were undercut, vertical, or steeply sloping.

Slight erosion - No slight erosion was encountered.
Moderate erosion - Unconsolidated material, small gullies, or undercutting in evidence.
Severe erosion - Unconsolidated material, sags, slides, and frequent gullies noticeable.

SEDIMENTATION IN THE RESERVOIR

Methods of Survey

Enlargements of aerial photographs to an approximate scale of 800 feet equal to one inch were used for horizontal control. Five base lines were chained to establish the scale of different sections of the photographs. Twenty-four ranges were established by triangulation and plotting on the aerial photographs, and water and sediment depths were determined along the ranges. Sediment observations were made with a spud. Water depths were determined by using a bell-shaped cast aluminum sounding weight in accordance with methods described by Eakin and Brown. 1/ Measurements along the established ranges were taken at intervals of 60 feet from crest level shoreline to points in the lake where the valley flats became quite uniform, and at intervals of 120 feet in the valley flats. In some locations the spud would not penetrate through the sediment and it was necessary to interpolate the pre-reservoir bottom elevations from original maps of the basin. Range locations are shown in figure 6.

Computations

Cross sections of the ranges were plotted showing both the original and present lake bottom. (See representative cross sections, figures 3 and 4). The cross section areas of both the sediment and water were obtained by planimetering. The surface areas of the segments formed by the ranges and crest shoreline were planimetered from the shoreline map based on the present survey. The following methods of computation were used to determine the original and present capacities of the reservoir:

(1) Segments 2-16 inclusive, 18-21 inclusive, and 23-25 inclusive, were computed by the range formual described by Eakin and Brown.

$$V = \frac{A'}{3}\left(\frac{E_1 + E_2}{W_1 + W_2}\right) + \frac{A}{3}\left(\frac{E_1}{W_1} + \frac{E_2}{W_2}\right) + \frac{h_3E_3 + h_4E_4 + \ldots}{130{,}680}$$

Where:

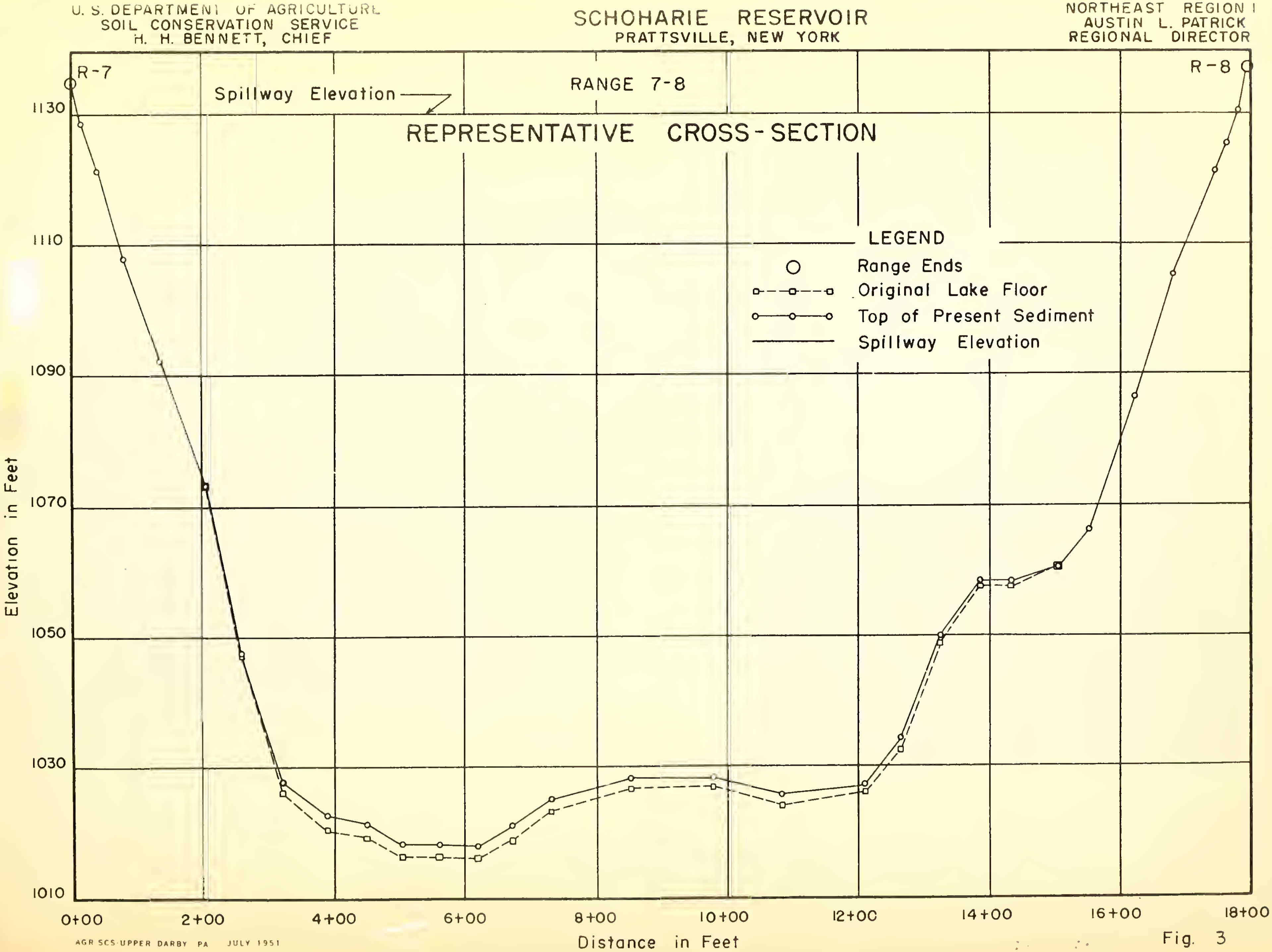
V = Original capacity or sediment volume in acre-feet.

A' = The quadrilateral area, i.e., the area in acres of the quadrilateral formed by connecting the points of range intersection with crest contour between the two principal or most nearly parallel ranges.

1/ Eakin, H. M., Silting of Reservoirs, U. S. Department of Agriculture. Technical Bulletin 524, (Revised by Carl B. Brown, 1939).

Use of Spud in measuring sediment thickness

Concrete post used in marking survey stations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R-7
R-8
Spillway Elevation
RANGE 7-8
REPRESENTATIVE CROSS-SECTION
LEGEND
Range Ends
Original Lake Floor
Top of Present Sediment
Spillway Elevation
Elevation in Feet
1130
1110
1090
1070
1050
1030
1010
0+00
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
Distance in Feet
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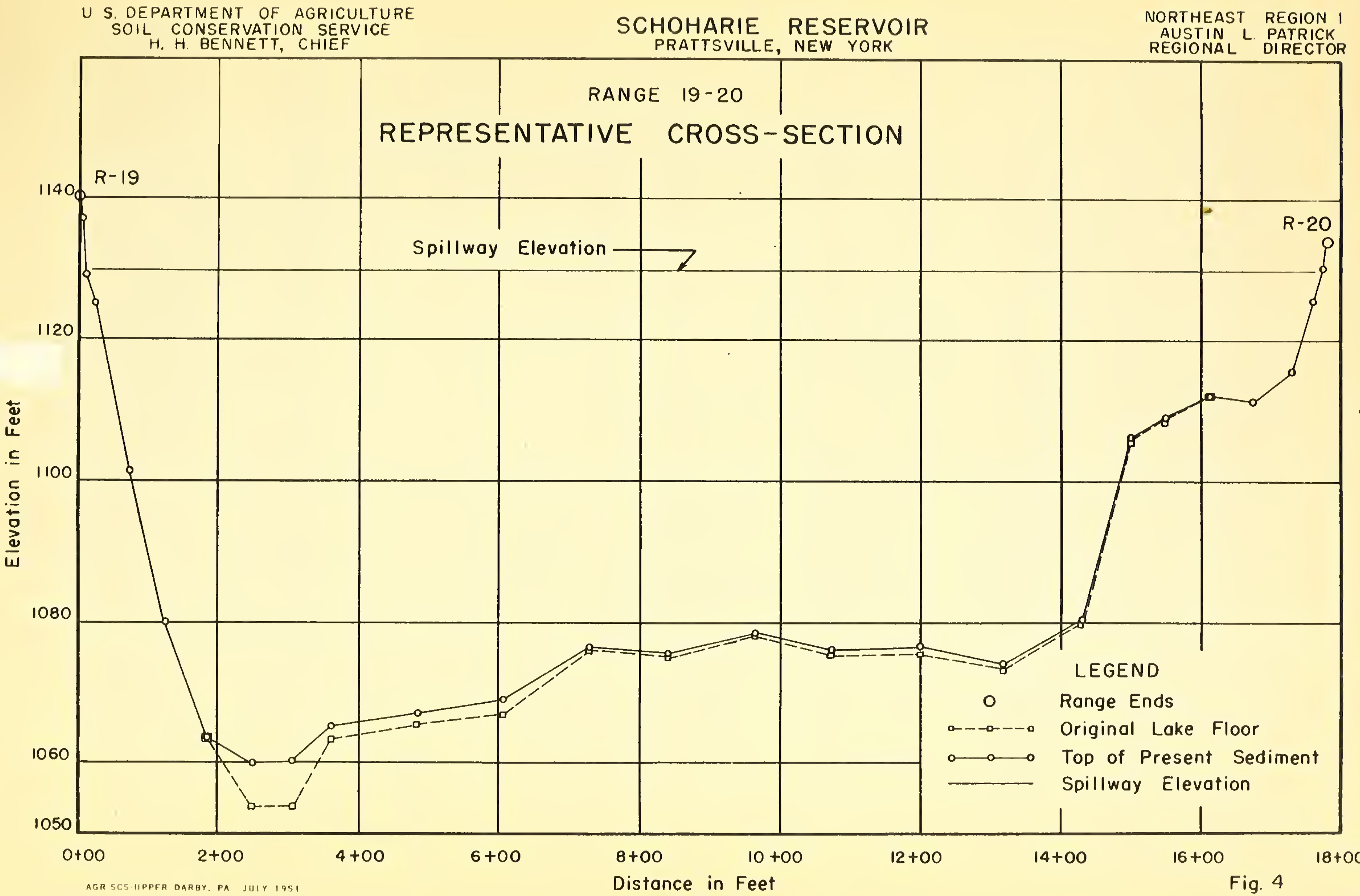
Fig. 3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RANGE 19-20
REPRESENTATIVE CROSS-SECTION
R-19
R-20
Spillway Elevation
Elevation in Feet
1140
1120
1100
1080
1060
1050
0+00
2+00
4+00
6+00
8+00
10+00
12+00
14+00
16+00
18+00
Distance in Feet
LEGEND
Range Ends
Original Lake Floor
Top of Present Sediment
Spillway Elevation
AGR SCS-UPPER DARBY, PA JULY 1951

Fig. 4

A = Reservoir area of the segment in acres.

E = The cross sectional area in square feet, of original capacity or sediment volume cut by a bounding range.

W = Width (length of bounding range) at crest elevation in feet.

h_3 = The perpendicular distance from the range on a tributary (where the segment is bounded by more than 2 ranges) to the junction of the tributary with the main stream, or if this junction occurs outside the segment, to the point where the thalweg of the tributary intersects the downstream range.

(2) The original capacity and sediment volume for the segment bounded by the dam and one range (segment 1) was computed by using the method described by Eakin and Brown.

For original capacity: $$V = A\frac{E}{W} - \frac{H\ B\ L}{174,240} + \frac{h_3E_3}{130,680}$$

For sediment volume: $$V = A\frac{E}{W} - \frac{L\left(2B - \frac{E}{W}s\right)\frac{E}{W}}{130,680} + \frac{h_3E_3}{130,680}$$

where:

L = Length of dam in feet.

B = Width of base of dam at original bottom of reservoir.

H = Height of dam, original bottom of reservoir to crest line.

s = Slope of upstream face of dam.

(3) For segment 17 (a channel segment where the ranges lack about 80° of being parallel) a modified mean depth formula was used.

$$V = \frac{A}{3}\left(\frac{E_1}{W_1} + \frac{E_1 + E_2}{W_1 + W_2} + \frac{E_2}{W_2}\right)$$

(4) For segment 22 (a curved end segment) the mean depth formula was used:

$$V = \frac{2A}{3}\left(\frac{E_1}{W_1}\right)$$

The original and present capacities of the reservoir were also computed by using the preceding formulas for the volumes above each of the following elevations: 1050, 1058, 1065, 1075.

Distribution and Character of Sediment

The sediment in Schoharie Reservoir is distributed in a manner quite uncommon to a normal water storage reservoir. The water level is usually lowered as much as 75 feet each year when outflow through Shandaken Tunnel exceeds inflow during summer months. As a result, water flowing into the

reservoir from creeks above the gatehouse during low lake stages flushes the channels of any silt and clay deposited in them while the lake was at higher stages. Bedload movement of sand, gravel, and small rocks occurs in the channels for a mile or more into the reservoir basin, ceasing only when back water decreases the velocity of the incoming water. Most of the sediment is deposited on the submerged valley flats and terraces of the reservoir basin and little or none is deposited on the steep side slopes. Above range 17-18 the sediment occurs in irregular deposits of reddish-brown sand, silt, and clay, usually compacted by drying in the sun during periods of low water levels. Below this range it is composed of loose gray or gray-brown silt. Fluctuating lake level allows wave action to occur on them and, as a result, the small amounts of sediment that may have been deposited are again picked up by the water and redeposited at lower levels.

A small dam across Schoharie Creek, in segment 11 of the reservoir, causes excessive sediment deposition in this area. The dam is about 1,000 feet long, with a maximum height of about 12 feet. It was used to direct water from Schoharie Creek into Shandaken Tunnel before Gilboa Dam was completed. The small dam was breached when it was no longer needed but the opening has now practically filled with sediment.

Elevations of the original bottom were determined from the original contour maps where old soil could not be found with the spud.

The exceptionally deep sediment deposits occurring on ranges 17-18, 17A-18A, and 17B-18B have been caused by this dam. A short distance out from Shandaken Tunnel entrance, the sediment has built a bar 8 feet above the sill of the tunnel. This prevents the water from being drawn down at present below elevation 1,058 feet, as compared to an original draw down elevation of 1,050 feet. This has reduced the original usable storage by 2,956 acre-feet, the amount of water stored between elevations 1,050 and 1,058. Ranges 17A-18A and 17B-18B were run to give a more accurate measurement of the sediment. The results indicate that nearly twice as much sediment has been deposited in the area as would have occurred if the dam were not there.

Sediment in the lower half of the reservoir, segments 1 to 8 on the reservoir map, is quite evenly distributed over the submerged valley bottom with deepest deposits in the channel. Average sediment depths amount to 1.3 feet on the old valley flats and 2.5 feet in the channel. Very little sediment was found on the steep side slopes. Capacity loss for those segments ranged from 1.1 percent for segment 6 to 1.9 percent for segment 8. Segments 9 to 12, in the vicinity of the gatehouse, have lost from 2.7 percent to 3.4 percent of their original capacities.

The greatest sediment depth in the reservoir was 10 feet on range 17B-18B. Upstream from range 19-20 only minor quantities of silt and clay have been deposited. Deposits of sand, silt, and clay, ranging from 0.1 to 1.3 feet deep, were found outside the channel on most ranges. The channel beds are composed of sand, gravel, and rocks with some rocks being a foot or more in diameter. The spud would seldom penetrate through the

layers of compacted sand, silt and vegetative matter that comprise the sediment.

One to five feet of deposition has occurred in the channels on several ranges. The channel on range 35-36 near the head of Bear Kill, and on ranges 27A-28, 29-30, 37-38, and 39-40 showed no deposition or some scour. Falls and rapids occurring at the head of Bear Kill and on Schoharie Creek immediately above range 37-38 are exposed during low water periods and account for the scouring action on those ranges. Capacity losses ranged from zero in segment 18 to 13 percent in segment 22.

Soundings on range 1-1A across a small bay, formed in the valley of Steenkill near the left end of the dam, indicate an unusually large amount of deposition. At the time the dam was built, Steenkill channel was moved further upstream to prevent the fill from blocking the channel and forming a separate pool when the lake was at a low stage. Very likely the constricted opening into the lake at lower levels has caused most of the sediment entering the reservoir from Steenkill to be deposited in the bay rather than spreading out into the main body of the lake.

Table 5 shows the amount of sediment in various sections of the reservoir, the proportion of the total sediment in each section, and relationships to the original storage capacity.

Table 5. - Distribution of storage capacity and sediment in Schoharie Reservoir by segments

Section	Capacity			Sediment	
	Original	Proportion of Total Original Capacity	Reduction in Capacity	Volume at Date of Survey	Proportion of Total Sediment
	(ac.-ft.)	(percent)	(percent)	(ac.-ft.)	(percent)
Lower Main Body, Seg. 1,2,3,4,5,6,7,8	49,029	76.8	1.3	660	59.0
Gatehouse Area, Seg. 9,10,11,12	6,717	10.5	2.9	193	17.2
Upper Main Body, Seg. 13,14,15,16,17,18,19,20	6,911	10.9	1.9	131	11.7
Head of Lake, and Side Bays, Seg. 21,22,23,24,25	1,164	1.8	11.6	135	12.1

SEDIMENT DISCHARGE FROM RESERVOIR

Studies of turbidity records of water passing through the gatehouse into Shandaken Tunnel during a 19-year period indicate a total of about 112 acre-feet of sediment has been carried out of the reservoir through the tunnel, equivalent to an average rate of 6 acre-feet per year. Presumably this material is deposited in Ashokan Reservoir. A small amount of the sediment is carried out of the reservoir during infrequent short periods of spillway overflow. No records are available from which an estimate of the amount of sediment passing out of the reservoir in this manner could be made, but it is probably less than 5 percent of the total sediment inflow.

SUMMARY

The sedimentation survey of Schoharie Reservoir shows that 1,119 acre-feet of sediment has been deposited in the reservoir in the past 23.8 years. Of this amount 417 acre-feet has been deposited in the dead storage area below elevation 1,050, and 702 acre-feet in the usable storage area between elevations 1,050 and 1,130. The average rate of deposition in the reservoir has been 47.02 acre-feet annually. (See table 6).

Deposition of sediment in the reservoir has reduced the original dead storage capacity 6.94 percent, the original usable capacity 1.21 percent, and the original total capacity 1.75 percent. Although the sediment deposited in the usable capacity occupied only 1.21 percent, an 8-foot bar that has formed in front of the tunnel entrance prevents full draw down and use of the original usable storage capacity. The amount of sediment in the usable capacity above the elevation of the bar has caused a further reduction of usable capacity amounting to 492 acre-feet. The total loss of usable capacity resulting from the bar and sediment accumulation amounts to 3,448 acre-feet or 1,124 million gallons, equivalent to nearly 6 percent of the original usable capacity.

The annual rate of sediment production from the watershed is equivalent to 0.16 acre-foot per square mile of drainage or 11.21 cubic feet per acre. Watersheds that are primarily in forest cover, with only small portions in cultivation, such as the watershed above Schoharie Reservoir, produce comparatively small amounts of sediment.

The rate of storage depletion of Schoharie Reservoir is low because of the low rate of sediment production from the watershed and the moderately high storage capacity per unit of drainage. In addition, about 10 percent of the sediment carried into the reservoir is discharged through the Shandaken Tunnel and it is estimated about 5 percent is discharged over the spillway.

Table 6. - Summary of sedimentation data
Schoharie Reservoir, Prattsville, N.Y.

	Quantity	Unit
Age 1/	23.8	Years
Drainage Area 2/	314	Sq. Mi.
Reservoir:		
Area at spillway crest stage:		
Original	1,078	Acres
Present	1,078	Acres
Original storage capacity:		
Usable storage	57,814	Ac. Ft.
Dead storage	6,007	Ac. Ft.
Total storage	63,821	Ac. Ft.
Present storage capacity:		
Usable storage	57,112	Ac. Ft.
Dead storage	5,590	Ac. Ft.
Total storage	62,702	Ac. Ft.
Total capacity per square mile of drainage:		
Original	203.25	Ac. Ft.
Present	199.69	Ac. Ft.
Sedimentation:		
Sediment in usable storage capacity	702	Ac. Ft.
Sediment in dead storage capacity	417	Ac. Ft.
Sediment passing through Shandaken Tunnel	112	Ac. Ft.
Total sediment	1,231	Ac. Ft.
Average annual sediment accumulation: 3/		
From entire watershed	51.72	Ac. Ft.
Per square mile of drainage area 4/	0.16	Ac. Ft.
Per acre of drainage area: 4/		
By volume	11.21	Cu. Ft.
By weight 5/	0.34	Tons
Depletion of storage capacity:		
Loss of capacity per year:		
Usable storage	.05	Percent
Dead storage	.29	Percent
Total storage	.07	Percent
Loss of capacity to date of survey:		
Usable storage	1.21	Percent
Dead storage	6.94	Percent
Total storage	1.75	Percent

1/ Storage began August 1926. Median date of survey May 5, 1950.
2/ Including reservoir. Reservoir area is 1.68 square miles.
3/ Includes an estimated 112 acre-feet of sediment discharged through Shandaken Tunnel.
4/ Excluding reservoir area.
5/ Assuming the dry weight of 1 cubic foot of sediment to be 60 pounds.

CONCLUSIONS

The rate of storage depletion of Schoharie Reservoir is low compared to the rates found elsewhere in the United States. Severe erosion is occurring on only about half of one percent of the drainage area, primarily on soil derived from lacustrine silts and clays on moderate to steep slopes in the valleys immediately adjacent to the reservoir. The inherent erodibility of these soils suggests that present rates of erosion and silting are not necessarily fixed but are subject to increase. The development of gullies in roadside ditches, the erosion on steep unprotected highway slopes and cultivation of steep sloping land can cause the erosion to increase or at least continue at the present rate. Those conditions should be corrected with a watershed treatment program in the interest of perpetuity of the water supply.

Sedimentation at the intake of Shandaken Tunnel is of greater immediate concern to the City of New York than the loss of usable storage through displacement by sediment. Six times as much usable storage has been lost because of the bar at the intake than by sediment displacement. Limited observations indicate that the bar has rapidly increased in size in recent years. Figure 5 shows that each foot increase in the height of the bar results in a proportionately greater loss of usable capacity in the reservoir. A detailed study of sediment movement in the vicinity of the intake should be made to determine the causes and remedy of the bar formation.

RECOMMENDATIONS

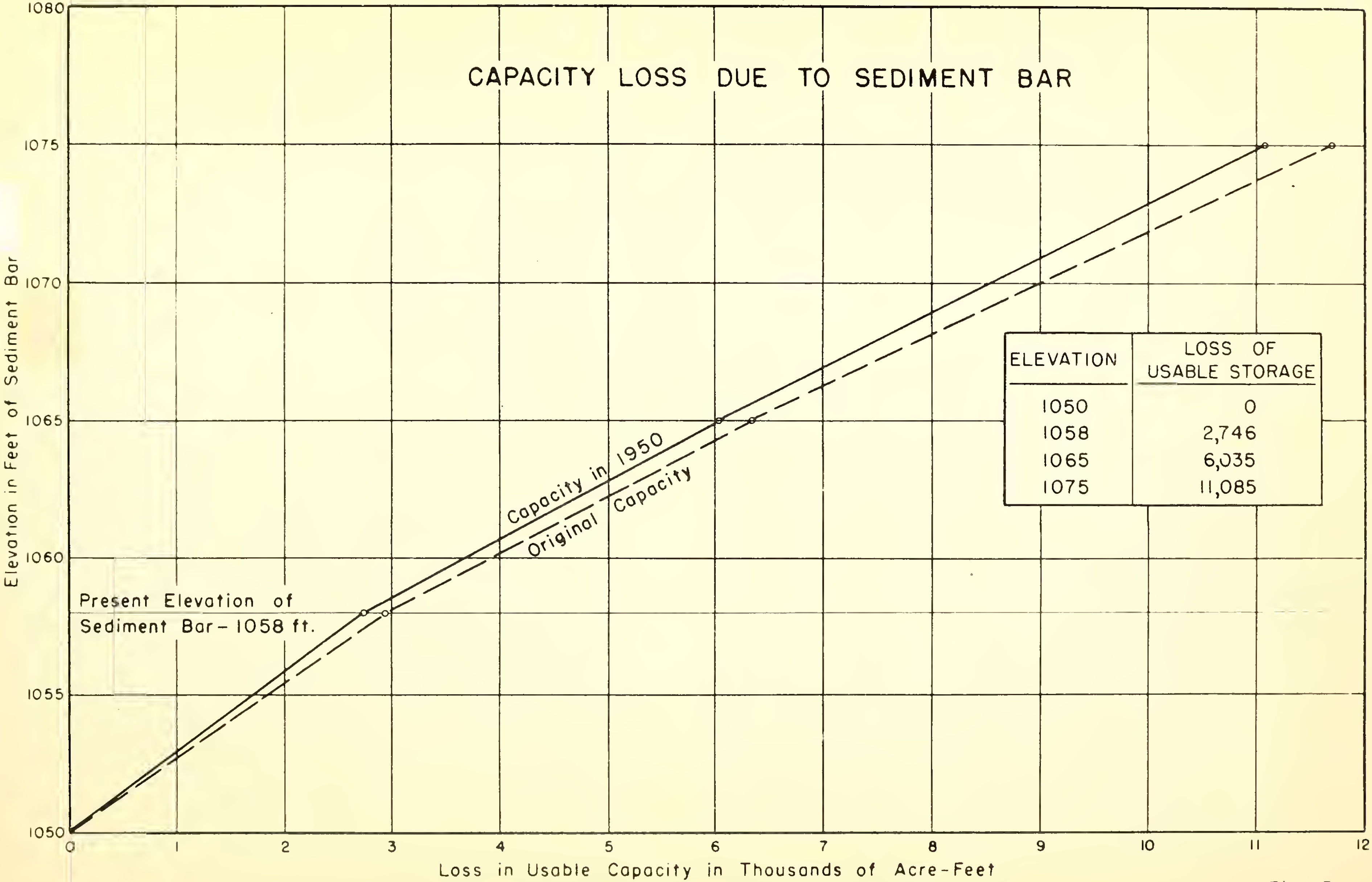
It is recommended that the City of New York make a detailed study of sediment movement in the vicinity of the intake to determine the best method of opening a channel through the sediment bar. The study should also determine whether the amount of water thus made available would justify the cost of opening and maintaining the channel.

It is also recommended that the City of New York cooperate and assist in developing a soil and water conservation treatment program on the watershed. This program should be carried out through the organized soil conservation districts of the area, and should provide for the installation of practices to reduce sediment production.

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
H. H. BENNETT, CHIEF

SCHOHARIE RESERVOIR
PRATTSVILLE, NEW YORK

NORTHEAST REGION I
AUSTIN L. PATRICK
REGIONAL DIRECTOR



ELEVATION	LOSS OF USABLE STORAGE
1050	0
1058	2,746
1065	6,035
1075	11,085

AGR SCS UPPER DARBY PA JULY 1951

Fig. 5

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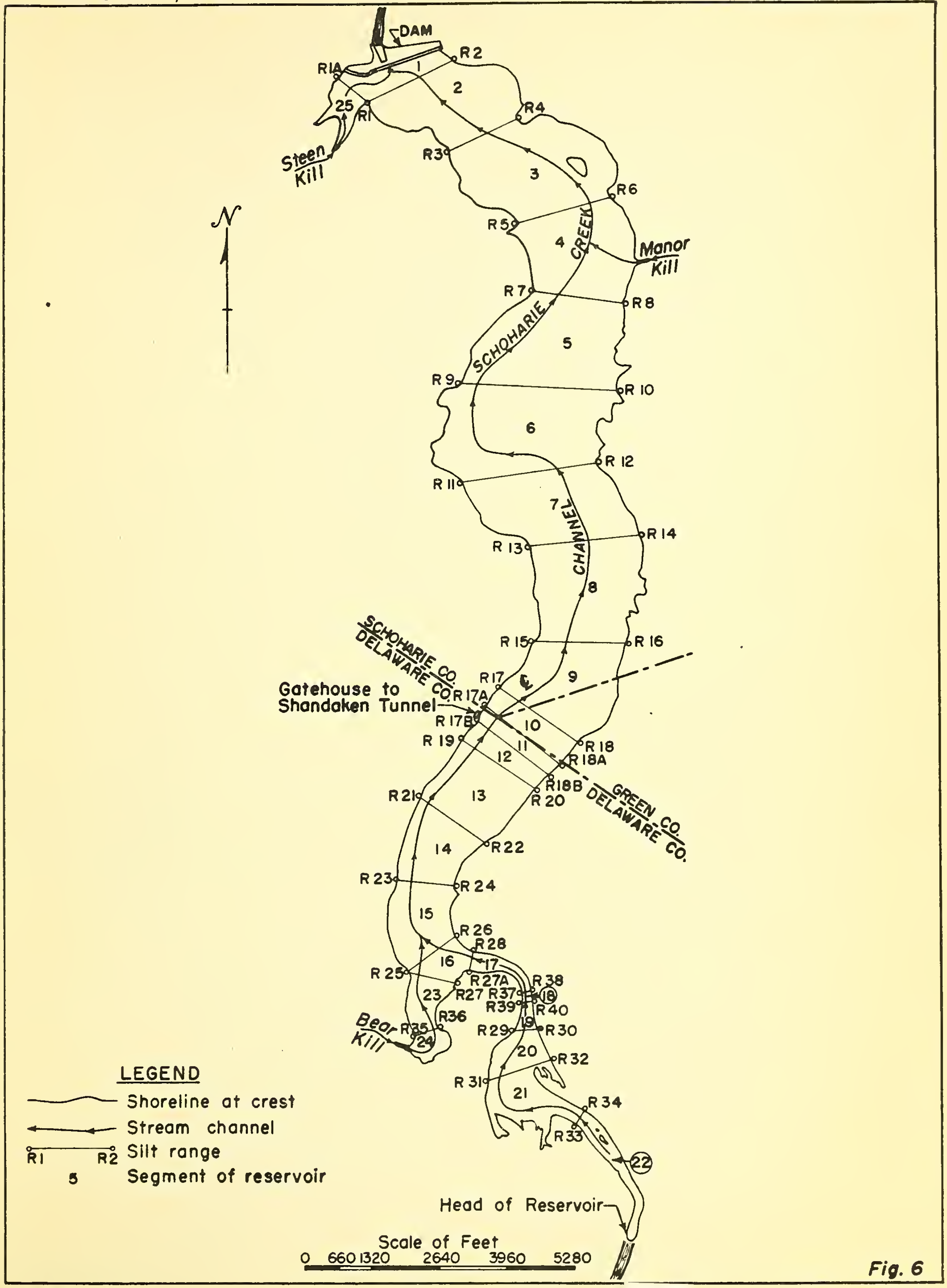

Fig. 6